

Original Article

A Comparison of Pain and Its Treatment in Advanced Dementia and Cognitively Intact Patients with Hip Fracture

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Abstract

Advanced dementia patients may be at substantial risk for undetected or undertreated pain. To examine the treatment of pain following hip fracture, a prospective cohort study was conducted in an academic teaching hospital. Fifty-nine cognitively intact elderly patients with hip fracture and 38 patients with hip fracture and advanced dementia were assessed daily. The cognitively intact patients rated their pain on a numeric scale ranging from 0 (none) to 4 (very severe). Analgesics prescribed and administered were recorded and compared to hip fracture patients with advanced dementia. The advanced dementia patients received one-third the amount of morphine sulfate equivalents as the cognitively intact patients. Forty-four percent of cognitively intact individuals reported severe to very severe pain preoperatively and 42% reported similar pain postoperatively. Half the cognitively intact patients who experienced moderate to very severe pain were prescribed inadequate analgesia for their level of pain. Eighty-three percent of cognitively intact patients and 76% of dementia patients did not receive a standing order for an analgesic agent. These data reveal that a majority of elderly hip fracture patients experienced undertreated pain. The fact that advanced dementia patients received one-third the amount of opioid analgesia as compared to cognitively intact subjects—40% of whom reported severe pain postoperatively—suggests that the majority of dementia patients were in severe pain postoperatively. This study and others suggest that directed interventions to improve pain detection and alter physician prescribing practices in the cognitively impaired are needed. J Pain Symptom Manage 2000;19:240–248. © U.S. Cancer Pain Relief Committee, 2000.

Key Words

Hip fracture, pain, dementia, postoperative pain

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Introduction

Despite recent efforts to improve the management of pain in the United States, undertreatment of pain, including postoperative pain, remains a persistent problem.^{1–4} This undertreatment appears to be particularly severe in the elderly.⁴ Recent studies have demonstrated that there exists a substantial degree of untreated and undertreated pain in the ambu-

latory and nursing home elderly,^{1,3,4} that health care workers persistently underestimate the amount of pain that patients experience regardless of their level of cognition,^{3,5,6} and that the elderly surgical patient is prescribed and receives significantly less opioid analgesics than a younger patient undergoing the same surgery.⁷ When "as needed" analgesics are ordered in the elderly, only 24% to 27% of the prescribed doses are actually administered; this percentage declines with advancing age.^{7,8}

Patients with dementing illnesses (e.g., Alzheimer's disease, vascular dementia) may be at even greater risk for undertreatment of pain. To date, there have been few studies that specifically have examined the treatment of pain in subjects with advanced cognitive impairment. In this paper, we compare analgesic prescribing in hip fracture patients with normal cognitive function to hip fracture patients with advanced dementia. Hip fracture serves as a useful model for this type of study because it is a common illness in the geriatric population (250,000 per year⁹), is seen in both cognitively intact and advanced dementia patients, and is associated with significant pain and loss of function. To examine pain management practices in this condition, we compared elderly hip fracture patients with intact cognition to a concurrent sample of advanced dementia patients with hip fracture who were hospitalized during the same interval at the same institution. Additionally, we prospectively evaluated pain severity before and after surgical repair in the cognitively intact subjects, and evaluated the adequacy of analgesic prescribing in this group. Our purpose was to use the pain ratings of the cognitively intact group as an approximation for the pain experienced by those with advanced dementia—a group unable to self-report their experience of pain.

Methods

All patients aged 70 years or older admitted to a large New York City teaching hospital with a diagnosis of hip fracture (femoral neck or intertrochanteric fracture) from September 1, 1996 to March 1, 1998 were eligible for inclusion. Patients were recruited by reviewing daily admission records of the medicine, geriatrics, and orthopedics services, and by physician and nurse referrals. Subjects were screened by a re-

search assistant within 24 hours of admission to the hospital Monday through Friday. Patients were excluded if they had a concomitant diagnosis of cancer, multiple internal injuries, a previous fracture in the affected hip, were non-English speaking, were screened for study entry more than 24 hours after surgery, or were delirious as documented by the Confusion Assessment Method (CAM)¹⁰ on 2 consecutive days following admission. After initial evaluation, potential subjects were administered the telephone version of the Mini-Mental State Exam.^{11,12} Those subjects scoring 18 or greater out of 24 (consistent with normal cognitive function) were eligible for enrollment in the cognitively intact group. Patients with delirium on admission as well as those with mild cognitive impairment were excluded so as to select patients with intact short-term memory to ensure accurate recall of pain. Subjects with a history of dementia and a Reisberg Global Deterioration Scale¹³ stage 6 or 7 (severe to very severe dementia) were enrolled in the dementia group.

Informed consent was obtained from all cognitively intact adults and from surrogate decision makers of those subjects with dementia. The study was approved by the institutional review board of the Mount Sinai School of Medicine.

Cognitively intact subjects were approached on a daily basis from Monday to Friday and asked to rate the severity of their pain on a 5-point numeric rating scale (0—no pain to 4—very severe). Subjects were asked to rate their average pain over the preceding 24 hours and were also asked to rate the severity of their worst episode of pain over the previous 24 hours. Patients interviewed on Monday were asked to rate their average and worst pain while in bed or sitting in a chair over the previous 48 hours. As part of the pain interview, patients were evaluated for the presence of delirium using the CAM. Patients who were found to be delirious were not interviewed on that day so as to ensure accurate recall of pain over the previous 24 to 48 hours. Advanced dementia patients were also assessed for delirium using the CAM. However, because only two ("acute onset and fluctuating course" and "altered level of consciousness") of the four CAM components (above plus "disorganized thinking" and "inattention") could be assessed in pa-

tients with advanced cognitive impairment, we also reviewed charts for notations by physicians, nurses, therapists, or other health care professionals regarding "a change or alteration in mental status", "new or increased" confusion, or a physician note documenting delirium.

All subjects (cognitively intact and dementia) had their charts reviewed on a daily basis for information about analgesic agents. The name of the agent, its dose, and frequency of administration (standing or as needed) were recorded. Aspirin, administered as a 325 mg standing dose once per day was not considered an analgesic. Medications were classified according to the World Health Organization (WHO) Analgesic Ladder¹⁴ as nonopioids (acetaminophen, aspirin, nonsteroidal anti-inflammatory drugs [NSAIDs]), "weak" opioids (codeine, oxycodone, hydrocodone), or "strong" opioids (morphine, meperidine, fentanyl, hydromorphone). No patient received parenteral NSAIDs in this study. Doses of all opioids, with the exception of oxycodone, were converted into parenteral morphine sulfate equivalents using published equianalgesic dosing guidelines.¹⁴ For oxycodone, recent data suggest that 1 mg oxycodone is equianalgesic to 1.3 to 1.5 mg of morphine sulfate¹⁵⁻¹⁷ as opposed to the 1:1 conversion recommended by the guidelines.¹⁴ An equianalgesic ratio of 1 mg of oxycodone to 1.5 mg of morphine sulfate was used in this study. We compared the mean daily amount of morphine sulfate equivalents administered to the cognitively intact and dementia groups preoperatively and through postoperative day 3.

In addition to these descriptive data, we also examined the adequacy of analgesic prescribing for the cognitively intact group. That is, we examined whether subjects in the cognitively intact group were prescribed an appropriate analgesic agent for their degree of pain according to Agency for Health Care Policy and Research (AHCPR) and WHO guidelines using the pain management index (PMI).³ The PMI has been demonstrated in multiple studies to be a useful indicator of the adequacy of analgesic prescribing.^{2,3,18,19} The index is constructed by subtracting the patient's self-report of pain (0—no pain, 1—mild pain, 2—moderate pain, 3—severe pain) from the strongest analgesic prescribed (0—none, 1—nonopioid, 2—weak opioid, 3—strong opioid). Subjects with a PMI

score less than zero have been prescribed inadequate analgesia for their level of pain. For the purposes of this study, we determined the PMI only for those patients who reported moderate to severe pain. That is, patients with moderate pain who were prescribed either a nonopioid or nothing and patients with severe pain who were prescribed only a weak opioid, a nonopioid, or nothing were considered to have inadequate analgesia for their degree of pain.

PMI scores were calculated for cognitively intact subjects who could be assessed preoperatively and for the first three postoperative days in all cognitively intact subjects. A preliminary analysis revealed that pain scores remained constant through postoperative day 3 before decreasing and thus, we averaged the worst pain scores reported for each of these three days to arrive at an overall score for use in the index. We used the strongest analgesic prescribed during the first three postoperative days to compute the analgesic component of the index. Thus, our index erred in the direction of presuming adequate, rather than inadequate analgesia.

T tests and chi-square statistics were used to compare patient characteristics and morphine sulfate equivalent doses for dementia and cognitively intact groups. We used multiple linear regression to examine the effect of age and fracture type on pain severity because these two characteristics were significantly different between the cognitively intact and dementia groups.

Results

There were 111 subjects who met entry criteria for the study. Of these, 98 (87%) agreed to participate. There were no significant differences in age, gender, site of residence, fracture type, and surgical repair between participants and nonparticipants. There were 38 subjects with advanced dementia and 59 who were cognitively intact. Patient characteristics are summarized in Table 1. Patients with advanced dementia were older, more likely to reside in a nursing home, and were more likely to have had an intertrochanteric fracture. There were no significant differences regarding delay to surgery or type of surgical repair. Of note, 3 of 38 dementia patients had nonoperative management of their fracture. The incidence of delirium in the cognitively intact

group using the CAM was 7% (4 of 58 subjects) and 13% (5 of 30 subjects) in the advanced dementia group. Using nursing and physician notes in addition to the CAM increased the incidence of delirium to 9% (5 of 58 subjects in the cognitively intact group) and 16% (6 of 38) in the dementia group.

Analgesic prescribing for both dementia and cognitively intact subjects was compared. Two patients received intravenous patient-controlled analgesia (PCA) infusions; the amount of medication that they received was not available from the medical record. These patients were excluded from the following analyses. The mean daily dose of parenteral morphine sulfate equivalent milligrams administered preoperatively was 2.6 mg in the cognitively intact group and 1.2 mg in the dementia group ($P < 0.001$). Through postoperative day 3, the mean daily dose of parenteral morphine sulfate equivalents was 4.1 mg for the cognitively intact group and 1.5 mg in the dementia group ($P = 0.002$). Seventy-six percent of dementia subjects (29 of 38) and 83% of cognitively intact subjects (48 of 58) did not have a standing

order for an analgesic agent (opioids or nonopioids) for their entire hospitalization (i.e., all analgesic medications were ordered "as needed" or "prn" ($P = 0.44$).

Of the 59 cognitively intact subjects who were enrolled, 38 were interviewed prior to surgical repair (Table 2). Seventy-nine percent of subjects (31 of 38) described their worst pain as severe to very severe and 43% (16 of 38) described their average level of pain as severe to very severe. For postoperative days 1 through 3, 81% of subjects (46 of 57) reported at least one episode of severe pain (67% had a mean worst pain score of severe to very severe over the 3 days) and 42% (24 of 57) reported their average level of pain to be severe to very severe (Table 2). Because the dementia subjects were significantly older and more likely to have an intertrochanteric fracture, we performed four regression equations using worst and average preoperative pain, and worst and average postoperative pain, as the dependent variables, and age and fracture type as the independent variables. Neither age nor fracture type significantly predicted pain.

Table 1
Patient Characteristics for 97 Subjects

	Cognitively Intact (<i>N</i> = 59) No. (%)	Dementia (<i>N</i> = 38) No. (%)	<i>P</i> Value
Median age (range)	82 (71–100)	88 (71–98)	0.001
Women	51 (86)	28 (74)	0.18
Ethnicity			0.207
White	54 (92)	31 (82)	
African American	5 (9)	3 (8)	
Latino	0	3 (8)	
Asian	0	1 (3)	
Residence			<0.001
Home	56 (95)	7 (18)	
Nursing home	3 (5)	31 (82)	
Dementia stage	Not applicable		
Stage 6		21 (55)	
Stage 7		17 (45)	
Fracture type			<0.001
Femoral neck	42 (72)	12 (32)	
Intertrochanteric	16 (28)	25 (68)	
Mean delay to surgery in days (range)	1.1 (0–4)	1.1 (0–3)	0.37
Fracture repair			0.381 ^a
Pin/plate	34 (58)	24 (65)	
Hemiarthroplasty	25 (42)	11 (27)	
Nonoperative management	0 (0)	3 (8.1)	
Median length of stay in days (range)	8.0 (1–22)	6.0 (2–72)	0.35
Delirious by CAM	4 (7)	5 (13)	0.29
Delirious by chart note	5 (9)	5 (13)	0.46

^aPin/plate vs. hemiarthroplasty.

The PMI was computed for patients both preoperatively and for postoperative days 1 through 3. Of the 38 patients for whom pain scores were available preoperatively, 37 (97%) experienced at least one episode of moderate to severe pain. For these 37 patients, 22 (58%) had a PMI score of less than 0. That is, those patients reporting moderate pain received only acetaminophen, NSAIDs, or nothing and those patients with severe pain received only a weak opioid, a nonopioid, or nothing. Following surgery, 52 of 58 subjects (79%) had a mean worst pain score that was moderate to very severe. For the 52 subjects who reported moderate to very severe pain, 26 (50%) had a PMI score of less than 0.

Discussion

Despite advances in the understanding and management of postsurgical pain, this study

found that pain was substantially untreated or undertreated in geriatric hip fracture patients. On average, 44% of cognitively intact individuals reported severe to very severe pain preoperatively and 42% reported a similar degree of pain postoperatively. Furthermore, in a group of patients for whom pain was a known and predictable outcome (postoperative as opposed to general medical patients), half the cognitively intact patients who experienced moderate to very severe pain were prescribed unarguably inadequate analgesia for their level of pain, and less than 25% received an order for standing analgesia during their entire hospitalization.

Perhaps the most disturbing finding of this study was that the cognitively intact subjects received, on average, triple the amount of opioid analgesia as those patients with advanced dementia. This difference is particularly striking given that more than 40% of the cognitively in-

Table 2
Pain and Analgesic Prescribing Practices For 97 Subjects

	Cognitively Intact (N = 59) No. (%)	Dementia (N = 38) No. (%)
Preoperative pain		
Severity of worst pain episode		Not measurable
None	0 (0)	
Mild	1 (3)	
Moderate	6 (16)	
Severe to very severe	31 (81)	
Severity of average pain		Not measurable
None	4 (11)	
Mild	7 (18)	
Moderate	11 (28)	
Severe to very severe	16 (40)	
Patients with moderate-severe pain receiving inadequate analgesia (n = 37)	22 (58)	Not measurable
Mean daily dose of parenteral morphine sulfate equivalents in mg (SD)	2.6 (4.55)	1.7 (2.13) ^a
Postoperative pain (days 1 to 3)		
Mean severity of worst pain for 3 days		Not measurable
None	0 (0)	
Mild	6 (10)	
Moderate	7 (12)	
Severe to very severe	45 (67)	
Mean severity of average pain for 3 days		Not measurable
None	5 (9)	
Mild	9 (16)	
Moderate	18 (32)	
Severe to very severe	24 (44)	
Patients with moderate-severe pain receiving inadequate analgesia (n = 26)	26 (50)	Not measurable
Mean daily dose of parenteral morphine sulfate equivalents in mg (SD)	4.1 (5.6)	1.5 (2.01) ^a

^aP < 0.001.

tact patients reported severe to very severe pain postoperatively. Furthermore, only 24% of these noncommunicative patients received an order for standing analgesia. The remaining 76% received analgesia only if they exhibited a visible behavior that could be interpreted as resulting from pain during a routine nurse or physician assessment. These data suggest that efforts are needed to dramatically rethink the treatment of pain and other distressing symptoms in the cognitively impaired.

A major difficulty in assessing and managing pain in the presence of advanced dementia is the inability of these patients to self-report their experience of pain. Nevertheless, observational data from nursing home patients with advanced dementia,²⁰ and data from subjects with mild to moderate dementia,^{21,22} suggest that dementing illnesses do not alter the fundamental experience of pain. Furthermore, studies using experimental stimuli to produce pain suggest that pain perception does not change with advancing age.²³ Patients with dementia, however, are often unable to express pain adequately, recall a painful episode that may have occurred previously, request analgesics, or operate PCA pumps.

While recent research suggests that accurate data may be gathered from patients with mild to moderate dementia,^{21,22} this is not possible in noncommunicative patients with advanced cognitive impairment. Although some investigators have attempted to assess pain in nursing home dementia patients by studying patient behaviors,²⁰ the scales rely upon caregivers or health care professionals who are quite familiar with the patients and who can respond to, and note, subtle changes in the patients' affect and behavior. Typically, such continuity of staff is not present in the acute care hospital. Although physiologic measures (e.g., heart rate, blood pressure) may be useful indicators of pain in younger adults, the elderly (both demented and nondemented) may show attenuated autonomic responses to pain and other provocative stimuli due to normal physiological changes of aging, comorbid conditions (e.g., diabetes), or medications (e.g., beta-blockers, other antihypertensives). Given these difficulties, we have previously proposed²⁴ using the experiences of cognitively intact adults as surrogate measures for the experiences of advanced dementia patients. It is both logical

and in the patient's best interest to assume that procedures and diseases that are distressing to people who are cognitively intact are likely to be similarly distressing to those with cognitive impairment, and that the experiences of pain of the cognitively intact can serve as a reasonable surrogate for those with advanced dementia.

In this study, both patient groups had similar surgical repair and postfracture management, and although the cognitively intact patients were younger and were more likely to have had a femoral neck fracture, neither of these characteristics was significantly associated with pain in regression analyses. Although one might argue that cognitively intact patients are more mobile and thus might experience more pain, we specifically asked about pain present only while patients were nonmobile (e.g., sitting in a chair or in bed). We also examined whether there were differences in the administration of adjuvant analgesics between the two groups (e.g., antidepressants, anticonvulsants). No differences were observed. Thus, there is not reason to believe that the untreated experience of pain in the dementia group was fundamentally different than that of the cognitively intact.

Although the treatment of pain in the elderly has recently received increasing attention,^{1,4,21} there have been almost no studies to date that have examined the management of pain in persons with profound cognitive impairment. The 38 patients enrolled in this study represent 12% of the total number of hip fractures seen at our institution during the 18-month study period. Although there are no data available as to the actual number of patients with advanced dementia who suffer a hip fracture, extrapolating our 12% figure to the 250,000 hip fractures that occur annually in this country⁹ results in 30,000 hip fractures in patients with profound cognitive impairment. Given the projected increases in the prevalence of both hip fracture⁹ and dementing illness,²⁵ it is likely that the number of hip fracture patients with advanced dementia will increase substantially and the question of how best to assess and manage pain in this vulnerable population of patients will assume even greater importance.

There are a number of possible reasons underlying the differences in analgesic prescribing that we observed between the cognitively

intact and advanced dementia groups. Clearly the inability of the dementia subject to communicate and report pain may prevent accurate pain assessment and thereby lead to sub-optimal therapy. Behaviors associated with acute pain in the elderly are not likely to be vigorous (flailing, screaming), but may in fact be quite subtle (excess sleep resulting from exhaustion secondary to pain, groaning, grimacing, resistance to movement, rigid body posture)²⁶ and disregarded if not carefully and specifically sought. The fear of exacerbating or precipitating a delirious episode in an otherwise stable postoperative elderly patient (particularly one with cognitive impairment) by employing opioids may also lead to inadequate pain management. Although two studies have identified opioids as a risk factor for delirium,^{27,28} neither adequately controlled for severity of pain. Indeed, it is possible that undertreated pain may be an independent risk factor for the development of delirium. Two recent studies of elderly patients found that uncontrolled pain, not analgesic intake, predicted the development of delirium postoperatively.^{29,30} With the exception of these two studies, there are currently no data available that explore the relationship between pain, opioid analgesics, and delirium. Nevertheless, the fear of using opioids because of their side effect profile (including delirium) is quite widespread and one that we have encountered within our own institution. Finally, there are a number of other barriers that have been previously well described (e.g., inadequate knowledge of the management of opioid side effects, misconceptions about the inevitability of pain following surgery, fear of addiction) that may have contributed to the inadequate analgesia reported in this study.^{2,26}

Conversely, there are a number of reasons to aggressively treat pain in the elderly postoperative hip fracture patient. In hip fracture, untreated or undertreated pain could have a substantial impact on functional outcome. Pain can induce tachycardia, increase myocardial oxygen requirements, and produce cardiac ischemia. Pain, or the fear of pain, may lead to limited postoperative physical activity, which may further increase the risk of thromboembolism. Inadequate analgesia may also lead to interruptions in physical therapy, delay patients' return to full weight bearing status, and thus

affect length of stay and postoperative functional recovery. Although opioid-induced sedation may interfere with physical therapy and return to weight bearing in patients without cognitive impairment or with mild–moderate dementia, patients with advanced dementia cannot cooperate with postoperative physical therapy and are unlikely to ambulate following fracture.³¹ Indeed, such patients cannot comprehend or understand why they are in pain and may refuse any activity that increases their pain (e.g., weight bearing, movement). As a result, inadequate analgesia may further prolong bed rest and decrease the probability that such patients will ever walk again. Finally, for the patient with advanced dementia, whose goals of care are often palliation and maximizing quality of life^{32,33} the relief of pain and other distressing symptoms should become the primary end-point of medical care.

There are several limitations to this study. First, these data were collected at a large tertiary care academic medical center and the data may not be generalizable to other institutions and other settings. Nevertheless, the limited studies that are available that describe analgesic prescribing and pain in the elderly^{3,4,7,8} suggest that our data are typical. Second, it is possible that patients were offered analgesic medications but refused to take them because of concerns about opioid analgesia (fears of addiction, side effects, dependence). However, nurses are required to note patient refusals of standing medications in the medical chart and we were unable to document any such refusals in our examination of the medical record and interviews with subjects. Finally, subjects may have been more willing to accurately describe their pain experience to our research assistant than to the treating nurse or physician. If true, this argues for the need for routinized and formal pain assessment on the part of the health care team to ensure identification of symptoms requiring treatment.

In conclusion, this examination of the treatment of pain in patients with and without advanced dementia after hip fracture suggests that cognitively intact hip fracture patients experience severe pain postoperatively and received inadequate analgesia for their level of pain, both pre- and postoperatively. Because patients with advanced dementia received only one-third the analgesia of their cognitively in-

tact counterparts, it is likely that the majority of these patients also experienced severe to very severe pain pre- and postoperatively. This study adds to the growing literature documenting the inadequate treatment of pain in elderly individuals^{3,4,21} and suggests that urgent steps are needed to address this significant health care issue.

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